CLAIMS

1. A method for producing synthesis gas containing hydrogen and carbon monoxide comprising the following steps:

- a step (a) of pre-reforming of a hydrocarbon mixture,

- a step (b) of reforming, in a catalytic ceramic membrane reactor (RCMC), of the pre-reformed mixture issuing from (a) by an oxidizing mixture containing oxygen to obtain raw synthesis gas containing hydrogen, carbon monoxide, carbon dioxide and water, and an oxygen-depleted mixture,

- and steps of preheating of the various fluids used,

characterized in that prior to step (b), the oxidizing mixture is heated to a temperature between 871°C and 1300°C, and preferably to a temperature of about 1000°C.

2. The method as claimed in claim 1, characterized in that the hydrocarbon mixture issuing from step (a) is brought to a temperature at least 111°C lower than that of the oxidizing mixture, prior to step (b).

3. The method as claimed in either of claims 1 and 2, characterized in that it includes a step of desulfurization of the hydrocarbon mixture prior to step (a).

4. The method as claimed in claim 3, characterized in that the hydrocarbon mixture is desulfurized, after the possible addition of hydrogen, at a temperature between 250°C and 450°C, and preferably at a temperature of 400°C.

5. The method as claimed in one of claims 1 to 4, characterized in that step (a) is carried out in a catalytic reactor at a temperature between 450 and 550°C, said reactor preferably being of the adiabatic type and the hydrocarbon mixture to be supplied to it preferably being preheated to a temperature of about 500°C.

6. The method as claimed in one of claims 1 to 5, characterized in that the depleted mixture issuing from step (b) is at a lower temperature than that of the oxidizing mixture supplied to step (b).

7. The method as claimed in claim 6, characterized in that the temperature difference between the oxidizing mixture supplied to step (b) and the depleted mixture is at least 75°C.

8. The method as claimed in one of claims 1 to 7, characterized in that the temperature of the hydrocarbon mixture before step (b) is between 550 and 670°C, preferably 650°C.

9. The method as claimed in one of claims 1 to 8, characterized in that the raw synthesis gas issuing from step (b) is at a temperature between 800°C and 1100°C, and in that the temperature of the depleted mixture is lower than that of said synthesis gas.

10. The method as claimed in one of claims 1 to 9, characterized in that it uses steps of cooling, separation and/or purification, and/or of treatment of the raw synthesis gas issuing from step (b).

11. The method as claimed in one of claims 1 to 10, characterized in that the oxidizing mixture supplied to step (b) is obtained by treatment of an initial oxygenated gas mixture containing 10 to 50 molar % of oxygen.

12. The method as claimed in one of claims 1 to 11, characterized in that the means employed for heat transfer during all or part of the steps of preheating of the various fluids of the method comprise at least one preheating furnace using the heat contained in the depleted mixture, and in that said furnace is also equipped with at least one postcombustion chamber.

13. The method as claimed in claim 12, characterized in that the oxidizing mixture is obtained by preheating the initial oxygenated gas mixture by heat exchange with the depleted mixture in a preheating furnace and/or by direct combustion of so-called

primary heating gas and depletion of said initial oxygenated gas in at least one combustion chamber.

14. The method as claimed in claim 13, characterized in that the initial oxygenated gas is all or part of the combustion gas available at the outlet of a gas turbine associated with the unit, under a pressure lower than 2 × $10^{[\delta]}$ Pa abs, and at a temperature between 500 and 600°C.

15. The method as claimed in claim 13, characterized in that the oxidizing mixture supplied to step (b) is all or part of the combustion gas available at the outlet of the combustion chamber of a gas turbine associated with the unit, under a pressure between 20 and 50 × 10^{δ} Pa abs and at a temperature between 1100 and 1300°C.

16. The method as claimed in claim 15, characterized in that the depleted mixture issuing from step (b) is supplied to the gas turbine for the cogeneration of electrical energy.

17. The method as claimed in claim 16, characterized in that the depleted mixture at the outlet of the gas turbine is supplied to the preheating furnace.

18. The method as claimed in one of claims 15 to 17, characterized in that the pre-reformed hydrocarbon mixture is supplied to step (b) at a pressure differing by not more than 10% from the pressure of the oxidizing mixture supplied to said step (b).

19. The method as claimed in claim 13, characterized in that the oxidizing mixture supplied to step (b) is formed by all or part of a first combustion gas available at the outlet of a first combustion chamber supplied with a first fraction of combustible gas and by an oxygenated gas, particularly combustion air available at the discharge of the air compressor of a turbine associated with the unit.

20. The method as claimed in claim 19, characterized in that the oxidizing mixture is

available under a pressure between 20 and 50 10^5 Pa abs and at a temperature between 871 and 1100°C.

21. The method as claimed in claim 20, characterized in that the pre-reformed mixture is supplied to step (b) at a pressure differing by not more than 10% from the pressure of the oxidizing mixture.

22. The method as claimed in one of claims 19 to 21, characterized in that the depleted mixture issuing from step (b) is mixed with the unused portion of the first combustion gas to constitute the oxygenated gas feed of a second combustion chamber also supplied with a second fraction of combustible gas.

23. The method as claimed in claim 22, characterized in that the second combustion gas issuing from the second combustion chamber is available under a pressure between 20 and 50 × 10^5 Pa and at a temperature between 1100°C and 1300°C, independent of the operating temperature of the RCMC.

24. The method as claimed in claim 23, characterized in that the second combustion gas issuing from the second combustion chamber is preferably expanded in the gas turbine to generate electricity.

25. The method as claimed in claim 24, characterized in that the combustion gas issuing from the gas turbine is advantageously supplied to the preheating furnace.

26. The method as claimed in claim 13, in which the initial oxygenated gas is all or part of the waste gas from a unit producing nitrogen from air, containing 25 to 40 molar % of oxygen, available under a pressure above 1.6 × 10^5 Pa abs and at ambient temperature.